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Automatic Biometric Fingerprint Sanitization System

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ABSTRACT

Fingerprint recognition is a safe and convenient biometric identification method that is increasingly being used for welfare program users. Many organizations employ fingerprint scanners to identify beneficiaries. The COVID-19 outbreak has jeopardized fingerprint authentication security. A group of people touching the sensors can result in viral transmission. COVID-19 can persist for at least 5 days on typical surfaces such as wood, plastic, metal, and glass, according to research. Despite all normal operational practices, shared public areas such as Ration Shops, attendance purpose in IT sectors and hospitals, etc... have raised the risk of virus transmission. In this context, the current study attempts to establish a safe and healthy environment for individuals by utilizing a UVC-based self-sanitizing technology for fingerprint scanners.

Keywords: UVC sanitizing; Fingerprint authentication; IoT; Biometric; Covid-19.

1. Introduction

Sanitation has always existed, but with the increased awareness of its importance during the pandemic, it has become one of the necessities. We feel safer when we sanitize our hands, electronic devices, and machines. Biometric devices are now being used by organizations for attendance and security purposes. For security and access control, enterprises rely significantly on fingerprint technology. Applying sanitizers before each fingerprint entry is time-consuming, and liquid sanitizers cause sensor degradation extremely quickly. The use of UVC light as a disinfectant prevents the spread of viruses and bacteria [1]. Ultraviolet-C (UVC) radiation has the ability to eliminate viruses while maintaining a non-hazardous environment for human health. The utilisation of technology in implementing a fundamental concept is poised to yield substantial and notably advantageous outcomes for society [2]. The objective of this manuscript is to examine the feasibility of reintegrating biometric technology while upholding stringent safety protocols and mitigating the potential transmission of viral pathogens.

The global community as a whole has picked up an important life skill as a result of the COVID-19 pandemic, and that is the significance of adhering to correct hygiene and sanitation procedures in public places [3]. In recent years, there has been a rise in awareness regarding the significance of thoroughly and routinely washing one's hands in order to prevent the spread of germs. As a direct consequence of this, companies and other types of organizations are conducting experiments with cutting-edge strategies to guarantee the security of their workforces as well as the wellbeing of their clients. The Biometric Fingerprint Sanitization System is an innovative solution that combines biometric authentication and sanitization technology to deliver a method of access control that is both secure and hygienic [4].

Before allowing entry to a restricted area or building, the Biometric Fingerprint Sanitization System will first perform an identity check by scanning a person's fingerprints. This can be done both physically and digitally [5]. This technology is utilised extensively in a wide range of industries, including healthcare and the financial sector, as

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well as the government, with the intention of ensuring that only authorised individuals are able to access sensitive data and secure facilities. In light of the recent COVID-19 pandemic, technology has been improved to include a sanitization function. This function makes use of UV-C light to kill germs and bacteria that may be present on the surface of the fingerprint scanner [6]. The users are required to place a finger on the fingerprint scanner, which then scans the user's fingerprint in order to verify the user's identity. This process is necessary for the working mechanism of the system. Following the successful verification of the user's identity, the system will activate the UV-C light within the scanner in order to eradicate any germs or bacteria that may have been hiding there. Because of this safety measure, the person who uses the toilet after you won't be exposed to any potentially hazardous microorganisms that were left behind by the person who used the toilet before you. These microorganisms could be harmful to their health [7].

The fact that the Biometric Fingerprint Sanitization System offers a touchless and hygienic method of access control is one of the system's most significant advantages. Traditional access control systems require users to physically interact with a keypad or enter a personal identification number (PIN) in order to gain entry [8]. This increases the likelihood that germs will be spread from one person to another within the building. The Biometric Fingerprint Sanitization System drastically reduces the risk of infection by removing the requirement that users meet surfaces. This eliminates the potential for the spread of germs. Additional safety features, such as those provided by the Biometric Fingerprint Sanitization System, are provided, which is unquestionably an advantage [9]. Biometric authentication is generally acknowledged to be one of the most secure methods of authentication due to the fact that it relies on one-of-a-kind physical characteristics that cannot be replicated or stolen. Through the utilisation of both biometric authentication and sanitization technology, it is possible to establish a system of access control that is both secure and hygienic.

The Biometric Fingerprint Sanitization System is a ground-breaking innovation that successfully addresses the dual challenges of cleanliness and safety in a wide variety of commercial and institutional environments. An access control system that makes use of biometric authentication and sanitization technology has been developed in order to guarantee the safety and health of the company's clientele [10]. The implementation of a biometric fingerprint sanitization system has the potential to play a pivotal part in the fight against the current COVID-19 pandemic.

2. Covid-19 and Case Studies

The pandemic caused by the 2019 Corona Virus Disease, also known as COVID-19, had consequences that had never been seen before, including a lockdown of the entire world. As a direct consequence of this, COVID-19 rapidly disseminated across the world, and its symptoms are still untreated. As of March 5, 2020, the biometric attendance systems that were installed in government buildings in Delhi were decommissioned [11]. A letter was dispatched across the nation to all of the Principal Secretaries, Secretaries, Municipal Corporations, and Autonomous Bodies in an effort to halt or at least significantly slow the spread of the virus.

The COVID-19 pandemic has so far affected 215 nations, with countries constantly setting new records for daily diagnosed cases eight months after the pandemic was announced. The role of infected surfaces or items contributing to touch transmission among modalities of Covid-19 virus transmission must not be overlooked [12],[13].

With the help of a cutting-edge piece of technology called the Biometric Fingerprint Sanitization System, you can control who can get into restricted areas in a way that is both safe and clean. This system combines different ways to clean with biometric authentication. After the COVID-19 pandemic, when businesses and organisations were looking for ways to make sure their employees and customers were safe and healthy, this system gained a lot of traction as a solution that could meet their needs. In this review of the relevant literature, we will look at the many studies that have been done on the Biometric Fingerprint Sanitization System, as well as its pros and cons and possible future research directions [14].

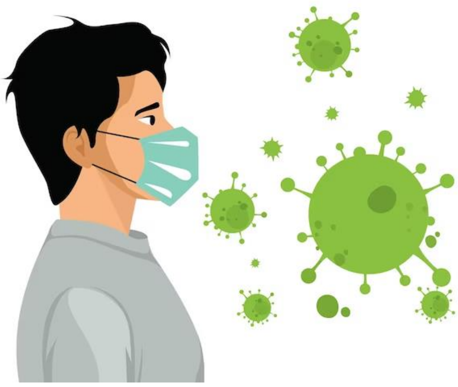

Figure 1. Image of self-protection from covid-19 by wearing mask

(SOURCE: Internet)

A lot of research has been done to find out how well the Biometric Fingerprint Sanitization System keeps places clean and safe in different settings. Researchers from the University of Malaya did a study to find out if the system was effective at lowering the risk of getting infectious diseases from touching dirty surfaces. They found out that the plan worked. The study's results showed that the system's interface was easy to use, and users gave it mostly positive feedback [15].

In a different study, researchers from the Indian Institute of Technology found that the Biometric Fingerprint Sanitization System worked well at both controlling access without touching the door and making sure the system was safe. The system was also found to be good at keeping people from getting in without permission. Along with other things, the study found that. The study's results showed that the system's user identification was reliable and accurate, and that the sanitization feature was able to remove germs and bacteria from the scanner's surface [16].

Researchers at China's University of Electronic Science and Technology found that the Biometric Fingerprint Sanitization System is a safe and clean way to solve the problem of controlling access to healthcare facilities. The study's results showed that the system was easy to use and greatly reduced the risk of getting sick from touching dirty surfaces [17].

As part of a biometric system that doesn't need to be touched, it was suggested that UV-C light be used to clean the fingerprint scanner. This was done to keep any possible contamination from happening [18]. The authors tested the system in a laboratory, where they found that it correctly identified users and cleaned the scanner's surface. Users suggested that an integrated biometric authentication and sanitization system could be used in healthcare facilities

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as part of an access control system. Biometrics would be an important part of the whole system. After testing the system in a hospital, the authors decided that it met their needs for a touchless and clean access control solution [19]. The authors say that a fingerprint recognition system with a sanitization function should be put in place to make it less likely that COVID-19 will be passed from person to person [20]. After testing the system in a controlled lab setting, the authors found that it met the requirements for a touchless and hygienic access control solution. After the system was shown to work, this was the conclusion that was reached [21].

The goal of the research was to find out whether or not the Biometric Fingerprint Sanitization System could be used as a safe and clean way to control access. The authors asked system users to fill out a survey, which showed that the system was well liked and that many users liked how it kept spaces clean and safe. This led the authors to decide that they should keep working on the system and make it better.

2.1. UVC Analysis

UV Germicidal Irradiation is a procedure that uses small, probable ultraviolet wavelengths to kill or subdue bacteria and virus by damaging nucleic acids, therefore disrupting their DNA and rendering it unable to perform important cellular tasks. UVC light is both effective at disinfecting viruses and safe for humans [1]. UV rays are primarily found between the visible and X-ray spectrums. According to the emission of UV light, there are three categories:

UV-A (315-400 nm); UV-B (280-315 nm); UV-C (100-280 nm).

UVC LEDs are available from International Light Technologies for a number of applications and uses. Some of the most common applications of UVC LEDs are:

Germicidal (UVGI) purification; Air Purification; Surface Sterilization; Hospital Sanitization.

2.2. Structure of UVC LED

The light guide layer was made of Al2O3, the refractive index NLGL was 1.782, and the thickness of the light guide layer (HLG) ranged from 150 to 700 m.

The LEL's upper surface emitted light, while the LEL's lower surface absorbed some light and reflected some, acting as both an absorbing and reflective layer. In order to achieve a balance between absorption and reflection, the UV-C LED electrode thickness Hpd was set to 1.5 m.

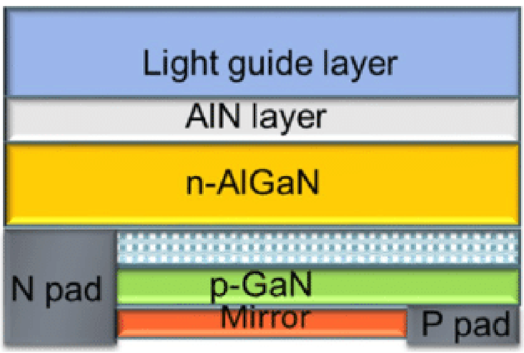

Figure 2. Structural diagram of UV-C LED

(SOURCE: Internet)

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3. Methodology

Ultraviolet-C (UVC) light-emitting diodes (LEDs) are readily available in the market and can be procured and employed for this objective. The luminary in question has been specifically engineered to be affixed onto a given surface and directed towards the area where the biometric sensor is located. The utilisation of the biometric system results in the generation of a disturbance caused by the individual's fingertips. The infrared sensor can detect the motion. The intended purpose of the delay duration is to ensure the safety of individuals who are exposed to UV radiation. A waiting period is recommended for safety purposes due to the lack of impact of UVC rays on the skin. The biometrics system is subjected to UV rays only subsequent to a specified delay period. Subsequently, the UVC rays are deactivated within a brief duration.

The UVC wavelength is unable to penetrate glass, thereby rendering it incapable of causing any damage to the biometric sensor. Moreover, the ultraviolet rays emanating from the head are solely concentrated on the glass surface where the individual places their finger for the purpose of identification. The transmission of UV photons through surfaces is contingent upon the chemical composition of the materials involved. UV radiation of greater wavelength has a higher probability of penetrating through.

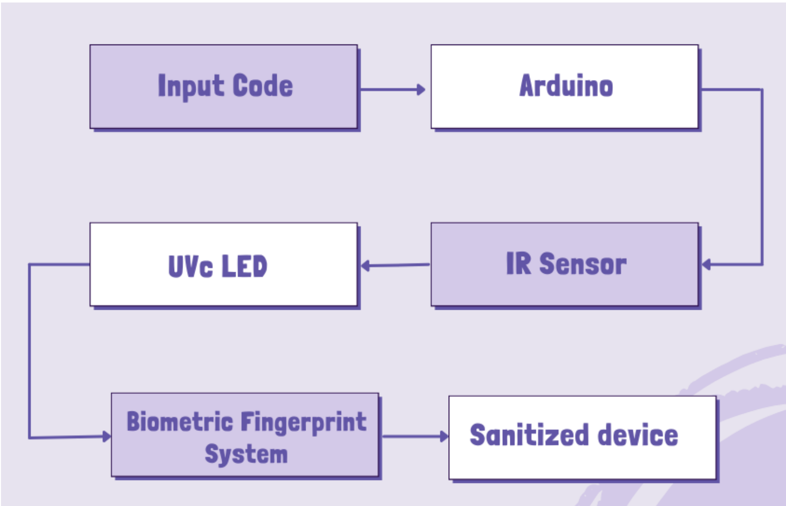

Figure 3. Block diagram of Automatic Biometric Fingerprint Sanitization System

The implementation of UVC light with shorter wavelengths, typically ranging from 207nm to 222nm, does not elicit any discernible impact on the human organism. The impact of the substance in question is limited to the fingerprint sensor, and does not extend to other bodily components. Its sole function is to neutralize or suppress the activity of any viral agents that may be present on the glass surface of the biometric device.

3.1. Proposed Solution

The application of ultraviolet-C (UV-C) light as a disinfectant is a helpful strategy for lowering the rate of contagious disease transmission. It has been demonstrated that exposure to UV-C light can effectively disinfect an infected area while also being completely safe for human use. The utilisation of ultraviolet-visible light-emitting diodes, also known as UV-C LED, results in DNA damage to a variety of microorganisms. Once they have been purchased, UV-C light-emitting diodes, also known as LEDs, are capable of serving this function and are

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commercially available. Light is transmitted from the LED, which is connected to the sensor, and received by the fingerprint reader. A disturbance is produced as a side effect of the operation of the biometric system as a result of the user's fingers. Motion can be detected more easily with the help of the infrared sensor that is connected to the UVC LED. After a certain amount of time has elapsed, the biometrics system is put through an ordeal in which it is subjected to intense UV light. After that, the UVC rays lose their ability to do their job in a very short amount of time.

Figure 4. Setup of the Automatic Biometric Fingerprint Sanitization System

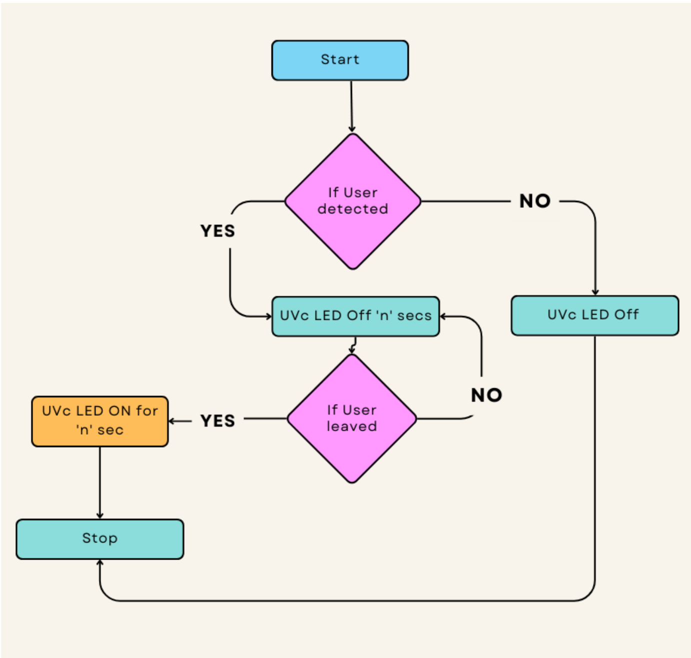

Figure 5. Flow diagram of the sanitization process

3.2. Arduino UNO

If one desires to enhance their comprehension of electronics and programming, it is advisable to contemplate procuring an Arduino UNO board. Among the Arduino family, the Arduino UNO board is widely popular and renowned for its comprehensive documentation. The Arduino UNO board is equipped with the ATmega328P microcontroller. The device provides PWM outputs on six out of its 14 digital I/O pins. In addition, the device features six analogue inputs, a reset button, a USB port, a power jack, and an in-circuit serial programming header.

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The ceramic resonator, with a frequency of 16 MHz, is located within the device. The apparatus additionally integrates a ceramic resonator that functions at a frequency of 16 MHz. The package comprises the microcontroller and its accompanying accessories. The system can be activated by connecting the device to a USB port on a computer. Subsequently, the device can be energized by either connecting an AC-to-DC converter or utilising batteries.

3.3. IR Sensor

An infrared (IR) sensor is a type of sensor that detects and measures radiation that is in the infrared spectrum. Although it exists in the same part of the electromagnetic spectrum as visible light, infrared radiation cannot be seen by humans because its wavelength is much longer than that of visible light. Anything that is warm to the touch will emit some amount of infrared radiation. There are two primary types of infrared sensors: active infrared sensors and passive infrared sensors. Active infrared sensors are able to both detect and emit rays of the infrared spectrum. Active infrared sensors are made up of two primary components, which are LEDs (light-emitting diodes) and receivers (also referred to as "photodiodes"). The infrared light that is reflected from the LED is picked up by the receiver whenever there is an object within range of the sensor. Active infrared sensors, which function as proximity sensors, find widespread application in obstacle detection systems.

3.4. Mantra Fingerprint Scanner

The fingerprint scanner utilises optical sensing technology, allowing for the recognition of fingerprints with varying degrees of quality. The Mantra MFS100 is a biometric fingerprint scanner that connects to a computer via a USB port. It's top-notch, and it can detect fake fingerprints and authenticate, identify, and verify users. The Mantra MFS 100 Optical Biometric Fingerprint Scanner is the best option for conducting online fingerprint checks. It's lightweight and compact, so it works well with the Aadhar system. Because it's compatible with so many different kinds of gadgets, using the scanner is a breeze. The Mantra MFS 100 Optical Biometric Fingerprint Scanner with OTG Cable has been approved by STQC. The scanner is compatible with a number of different systems, including Windows and Android.

4. Conclusion

The utilization of optical sensing technology in the fingerprint scanner facilitates the recognition of fingerprints with varying degrees of quality, ranging from substandard to exceptional. The Mantra MFS100, a biometric fingerprint scanner, establishes a connection with a computer by means of a USB port. The biometric system exhibits exceptional standards and possesses the capability to detect fraudulent fingerprints, while also performing the functions of user authentication, identification, and verification. To achieve optimal precision in online fingerprint verification, the Mantra MFS 100 Optical Biometric Fingerprint Scanner is the most suitable option. Due to its compact size and space-saving attributes, it exhibits compatibility with the Aadhar system. The scanner's compatibility with a diverse range of electronic devices ensures its user-friendly operation. The Mantra MFS 100 Optical Biometric Fingerprint Scanner with OTG Cable has received certification from the STQC. The scanner exhibits compatibility with a diverse range of operating systems, encompassing Windows and Android, among other options.

Declarations

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This study did not receive any grant from funding agencies in the public or not-for-profit sectors.

Competing Interests Statement

Authors have declared no competing interests.

Consent for Publication

The authors declare that they consented to the publication of this study.

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